



# SEAWEED AND WOMEN: A NEXUS OF HEALTH, HYGIENE, AND ECONOMIC SUSTAINABILITY

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## ABSTRACT

Seaweed, an abundant marine resource, has long been recognized for its nutritional, medicinal, and ecological significance. Seaweed has been used traditionally in feminine hygiene practices for its absorbent and soothing properties, particularly in coastal communities. Modern innovations now utilize seaweed-derived biopolymers like alginate and carrageenan in biodegradable sanitary products, offering antibacterial, anti-inflammatory, and eco-friendly alternatives to synthetic materials. Seaweed-based supplements also contribute to menstrual and reproductive health. Beyond hygiene, seaweed cultivation empowers women economically, especially in coastal regions. However, further research is needed to validate the clinical efficacy of these products and optimize their use in sustainable hygiene solutions.

**KEYWORDS:** Seaweed, Female Hygiene, Women Empowerment, Sustainability, Biodegradable Sanitary Products

## INTRODUCTION

The oceans, and in particular their coastal areas, are a vital component of the Earth's ecosystem, comprising between 500,000 and 10 million species that provide a wide range of ecosystem services. Ocean sustainability embodies the approach required to manage our oceans and the services they provide. The oceans are pioneer contributors to the global economies also in the transportation, energy and tourism sectors. The United Nations estimated that "over three billion people depend on marine and coastal resources for their livelihoods". The oceans and their resources are therefore critical to food security and human welfare while providing an essential buffer to global climate warming and a vital barrier against biodiversity loss.

It is presumed that the unique features of the maritime environment, where the sea weeds macroalgae are grown, are mainly responsible for its properties (Dhargalkar, V). The seaweeds are dispersed horizontally in different zonations viz. supratidal (supralittoral), intertidal (littoral), and subtidal (sublittoral) regions of the seas and oceans.

Seaweeds can be thought of as marine plants, but in a real sense, they are marine macroalgae that complete their nourishment necessity for growth and maintenance through photosynthesis in maritime environments. This autotrophic organism is primarily found in estuaries, lagoons and oceans. One of the most significant features that differed from plant to algae is the absence of a circulatory system. Necessary nutrient absorption and internal movement are carried out through transfusion between cells and between the environmental and the epidermal cells (Nirali Mehta and Shailesh Mehta, 2023).

Seaweeds found in the intertidal, shallow, and deep waters of the sea up, to 180 m depth and in estuaries and backwaters. They grow on substrates like rocks, corals, stones, pebbles, and also as epiphytes on sea grasses. For several centuries, seaweeds have been used as a vital part of the diets and culture attributing many healthful benefits to their use.

## MATERIALS AND METHODS:

All the data elucidate in this article have been collected from several secondary sources by reviewing research articles, news articles, reports, different websites, survey etc. all of these data gathered here were comprehensively reviewed.

## RESULTS:

### Seaweed to Female Hygiene

An integrated plan for empowering women and sustaining ecological health is produced by the incorporation of seaweed into female health, hygiene, economic development, and environmental sustainability. Seaweed promotes sustainable development for women globally as a socioeconomic tool and biological resource. This relationship is biological, medicinal, cultural, and socioeconomic.

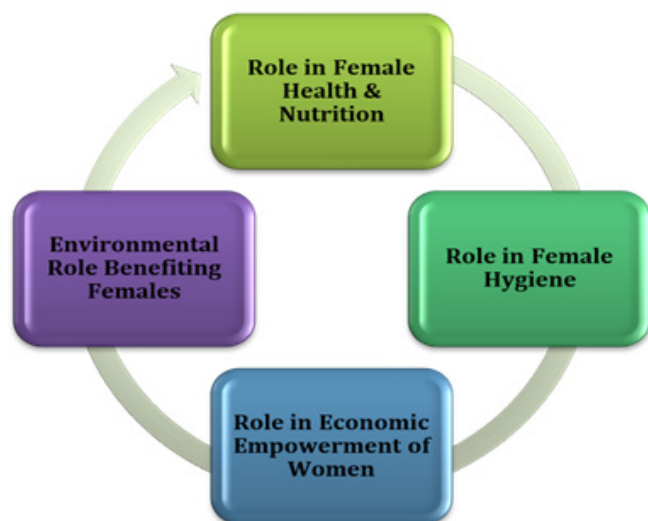
Seaweeds are rich in bioactive compounds essential for women's health. These include iodine, calcium, magnesium, iron, vitamins (A, C, E, K, B-complex), polyunsaturated fatty acids, and dietary fiber, antioxidants, and antimicrobial compounds all of which play critical roles in maintaining hormonal balance, reproductive health, and disease prevention in females.

### Traditional Uses of Seaweed in Female Hygiene

Historically, seaweed has played an important but often underrecognized role in the health and hygiene practices of coastal communities, especially for women.

Coastal communities in parts of Scotland, Ireland, and Japan traditionally used dried seaweeds such as *Ascophyllum nodosum* and *Fucus* species as absorbent padding during menstruation or postpartum care. These were often wrapped in cloth and used for personal hygiene. Seaweed poultices were applied to relieve skin irritation or infections related to intimate hygiene. Red algae (*Rhodophyta*) rich in anti-inflammatory properties were occasionally used for this.

In some Asian coastal regions, women used seaweed-based baths (e.g., with *Saccharina japonica*) after childbirth for their skin rejuvenating and antiseptic properties for postpartum care. In traditional Chinese medicine (TCM) and Ayurveda, certain seaweeds like *Sargassum* species were used to regulate menstruation, reduce menstrual pain, and improve fertility by supplying essential trace minerals like iodine and iron.



**Figure 1: role of seaweed in field of the female Health, Hygiene, and Economic Sustainability**

### Role in Female Health & Nutrition

Seaweeds, or marine macroalgae, are rich in antioxidants, polysaccharides, vitamins, and antimicrobial compounds, making them suitable for both external hygiene products and medicinal applications in women's health. Certain seaweed extracts inhibit the growth of *Candida*, *Staphylococcus*, and other microbes related to infections.

Iodine deficiency is a leading cause of thyroid disorders such as goiter, hypothyroidism, and reproductive issues like irregular menstruation and infertility (Zimmermann & Boelaert, 2015). Seaweeds are natural sources of iodine, essential for thyroid function critical for female hormonal balance, pregnancy health, and fertility. Seaweed, especially brown species (e.g., *Laminaria digitata*, *Ascophyllum nodosum*), is one of the richest natural sources of iodine, supporting thyroid health in women. Teas et al. (2004) demonstrated that postmenopausal

women consuming seaweed had improved thyroid function and hormonal balance.

Iron & Calcium Source are beneficial for preventing anemia in menstruating women and promoting bone health, especially in pregnant and postmenopausal women. Red algae species, such as *Gracilaria* and *Porphyra*, are excellent plant-based iron sources (Rupérez, 2002).

Calcium and magnesium, abundant in seaweed, are beneficial for bone health, particularly to prevent osteoporosis in postmenopausal women (MacArtain et al., 2007).

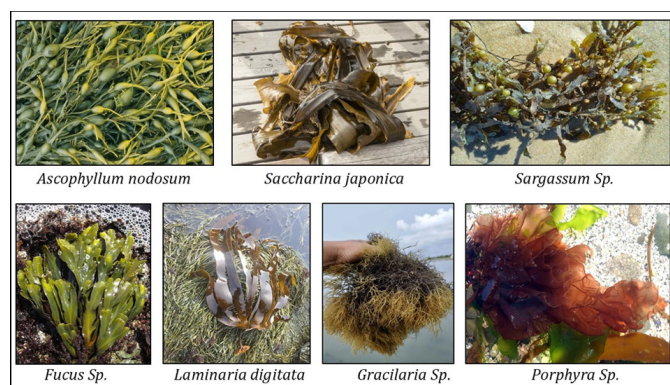
### Role in Female Hygiene

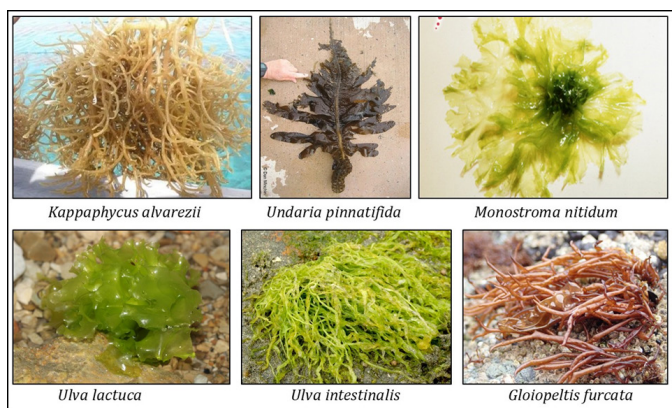
Anti-cancer Properties such as Fucoidan and phlorotannins derived from brown seaweeds exhibit anti-cancer properties, including against breast and ovarian cancers (Ale et al., 2011; Fitton et al., 2015).

Antimicrobial agents such as carrageenan, fucoidan of seaweed extracts are added to feminine lubricants, lotions, and washes to help prevent *Candida albicans* infections. The anti-HPV and anti-HIV capabilities of carrageenan, derived from red algae like *Kappaphycus alvarezii*, have been confirmed. It is utilized in feminine hygiene gels (Cone et al., 2006; Carlucci et al., 2004). Alginate application is used in postpartum and gynaecological surgeries to promote healing, prevent infections, and absorb exudate (Draget et al., 2005).

Many women experience dysmenorrhea, or period cramps, which are brought on by inflammation and contractions of the uterine muscles. Brown seaweed consists of anti-inflammatory compounds such fucoidan and phlorotannin that reduce inflammation and may naturally decrease menstruation pain. Ale et al. (2011) reported about brown algae extracts' ability to reduce inflammation. The presence of vitamin- B and magnesium in seaweed helps to control neurotransmitters and lessen the symptoms of premenstrual syndrome (PMS), including breast tenderness, bloating, and mood swings.

According to Shanab et al. (2018), fucoidan exhibits antifungal excitement against *Candida albicans*, which is frequently cause of vaginal infections. Both *Candida* and *Staphylococcus aureus* growth were suppressed by Ulvans derived from *Ulva lactuca* (Kandhasamy & Arunachalam, 2008).





(photograph taking from the online sources)

**Figure 2: Seaweed/Marine macroalgae used in different seaweed-based products**

**Biodegradable Sanitary Pads:** An environmentally friendly sanitary pad is being developed using alginate fibres derived from seaweed. Implementing biodegradable alginate fibres from brown algae (*Laminaria*, *Sargassum*) are used in the production of sanitary napkins (Mohan et al., 2019). Talaromyces claims that Water-soluble fibres extract from the *Zostera*, and the seaweed such as *Undaria pinnatifida*, *laminariae*, *Sargassum microlorum*, *Cyrtomenia sparsa*, *Monostroma nitidum*, *thallus Porphyrae*, *Eucheuma gelatinosum*, and *Gloiopeltis furcata* act as a natural absorbent. The dried seaweed can produced natural absorbent particles that are typically between 0.1 and 5 mm in diameter. Dried form of *Undaria pinnatifida* has water-soluble fibre that can absorb water up to eight times its dry weight. One gramme of natural absorbent based on *Undaria pinnatifida* can absorb around eight millilitres of blood, exceeding the highest quantity discovered in natural plants.

### Role in Economic Empowerment of Women

In many coastal regions women lead seaweed cultivation, offering them income and independence. In the Philippines, Indonesia, Tanzania, and India (Tamil Nadu), women's cooperatives cultivate *Eucheuma* and *Kappaphycus* (Valderrama, 2013). These Self-Help Groups (SHGs) support gender equality by empowering rural women's organizations in coastal villages. As an entrepreneurial endeavor, women are engaged in the production of value-added items derived from seaweed, such as soaps, face packs, lotions, fertilizers, and biodegradable sanitary pads (Pereira, 2018).

### Environmental Role Benefiting Females

Biodegradable Hygiene Alternative products reduce plastic pollution, protecting female reproductive health from exposure to harmful chemicals. Seaweed-based sanitary pads break down naturally within 3–4 months, reducing landfill waste compared to synthetic products that take centuries to degrade (FAO, 2018). A 2022 study in the Journal of Biomaterials showed seaweed-based sanitary pads could degrade within 3 months compared to synthetic pads taking 500-800 years. Lohmann, 2017 documented that conventional sanitary pads contribute to microplastic pollution, which can harm female reproductive health through endocrine disruption. Along with providing climate-resilient livelihoods for coastal women,

seaweed farming mitigates carbon emissions by sequestering CO<sub>2</sub> (Duarte et al., 2017).

### CONCLUSIONS:

The integration of seaweed-based nutrition and hygiene products proved their sustainable, and effective approach to resolving menstrual health challenges in women. However, current investigation of research is largely fragmented, and comprehensive clinical or community-based studies associating seaweed consumption with improved menstrual outcomes are lacking. Research organization and government has need to focus on how to introduced the seaweed base products especially in rural and conservative communities. life-cycle assessment (LCA) studies are required to quantify the real-world environmental benefits of seaweed-based product. Encourage government programs and NGOs to promote seaweed-based women's enterprises, fostering female economic empowerment along with menstrual hygiene improvement. Launch community engagement programs in coastal and rural regions to educate women on the nutritional and environmental benefits of seaweed for menstrual health.

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